ficient to kill an animal whose spleen has not been subjected to this training, may ba introduced without ill effect.

On this theory, the production of immunity consists of a special education of certain cells and artificial immunity becomes essentially cellular. The differance between immunity and tolerance I conceive to be this: In the former, the of certain organs become aggressive, a special function is developed. The poison introduced is destroyed. In tolerance, there is no aggressive action on the part of any organ.

There is no development of speeial functions. The poison introduced is not destroyed, it only fails to kill.

Now what can be said about the relation between thc principles of inmunity and those of cure? Are they tho same? I think that there are essential differences. In the first place, the substances with which inmunity is induced are not applicable in the production of a cure. They are already in the body and have failed to stimulate the nuclein-forming cells in such a manner as to cause their own destruction. To introduce more of the bacterial poison after the invading virus has established itself in the system will only strengthen the invader.

If I am right concerning this differance between the agents of inmunity and cure, to what source shall we look for curative substances in the infectious diseases? Either we must introduce into the body some germicide formed by other cells, or we must employ other agencies for the purpose of stimulating the nuclein forming cells.

Blood-serum therapy offers the first of these alternatives, and now that we know that the germicidal constituent of the blood is a nuclein, blood-serum therapy will give place to nuclein therapy, and with the latter there is more hope of accomplishing good results because it reduces the size of the dose.

Now that we have learned that the animal body itself generates a germicide more powerful in its action than corrosive sublimate, and since we know how to increase the amount of this substance in the blood and can insolate it and inject it into other animals, a new theory of the treatment of diseases is opened to us.

If it be possible to kill the germs or destroy thc bacterial poison after the development of an infectious disease, by the introduction of a germicde or a toxicide formed by other cells than those of the infected person, then we may expect that cures for diseases of this kind will be found in the near future. Experimentation offers the only means of ascertaining whether or not this be possible. The recently reported cases of tetanus successfully treated with the antitoxin of Tizzoni and Cattani, obtained from the blood of animals which have been rendered immune to this disease, are in accord with this principle.

If nuclein therapy fails us, we must strive to find agents that will stimulate the nuclein forming glands. This probably is the shief factor in the climatic treatment of tuberculosis, but so far as our knowledge of medicinal substances that will accomplish this result goes, we are practically and wholly ignorant.

I have used the "cure," limiting its meaning to the destruction of the germ or other poison. If we could destroy all of the bacilli in the body of a tuberculous patient, would a cure be effected? If we ever reach this desideratum. nature will probably do the rest.

CONSCIOUSNESS UNDER THE INFLUENCE OF CANNABIS INDICA.

BY E. W. SCRIPTURE, YALE UNIVERSITY, NEW HAVEN, CONN.

THE statement is generally madc that the extract of *Cannabis Indica* (flowers of the Indian hemp whose leaves and resin furnish hashish) causes time and space to be greatly lengthened in consciousness. Wishing to know what is meant by these statements I obtained the prescription:

Rx.
Ex. Cannabis Indicæ (P. D. & Co.) 1 oz.
Alcohol 20 oz.
M. Lig. Alcoholic solution of extract of Cannibis indica. One drachm contains three grains. Commencing dose ten drops containing one-quarter grain of the extract.

One evening I took ten drops as prescribed. No effects were noticed for over 45 minutes. Concluding that the dose was not strong enough I gave up the experiment for that occasion and drank a mug of beer preparatory to retiring. The narcotic action of the hops probably assisted in bringing on the effects of the dose. It is to be noted that my consciousness is very suspectible to the influence of narcotics.

For over an hour and a half, till final sleep occurred, and in a lesser degree throughout the next day, several important changes in mental life were observed. The most striking was the fluctuation of attention. The experiments of Lange (Philos. Studien, IV, 390) and of Eckener, Pace and Marbe (Philos. Stud., VIII, 343, 388, 615) have demonstrated the phenomenon as a normal condition for weak stimuli. For example, the faint ticking of a watch is alternately lost and heard. It holds good also of stronger sensations; the ticking of a clock, although loud, will vary in its apparent intensity. The immense fluctuations under the influence of hemp can be illustrated by the following case which occurred several times. A horse car is heard approaching; shortly afterward I find that the sound enters anew into consciousness; again it enters anew, and this is repeated through all the phases of approach, passage and retreat of the car. While listening to the sound, it somehow slips away, just as in Lange's experiment, and returns after a while. In describing the phenomenon I have avoided saying that the sound is heard, dies away, is heard again; all that is known in consciousness is the repeated entrance of the sound and the memory of the fact that it had been lost out of view a moment before.

The next most striking phenomenon was the remoteness of objects in their relation to myself. After the phenomenon had begun to be noticeable I wrote down on the spot the condition I found myself in. The words are: "Events seem more distant in feeling of subjectivity—events happened seem to have happened in time remotely related to the observer—apparently the time seems quite remote—yet after all it is not really longer than the usual time. Events in space are less personal, yet not further away. My feet on a chcir in front do not seem so close to me but my legs are not longer." I could estimate a period of five minutes quite correctly; I could touch objects without any noticeable error of estimation. Yet events of five minutes ago belonged to the past and objects on the table beside me seemed scarcely to be there for me to reach them. During the following day I several times noticed that a minute after seeing a place or an object, the event might as well have occurred on the previous day.

All these phenomena, in a minor degree, I have frequently observed when depressed by dull weather or by fatigue. On those occasions and under the influence of hemp there seems to be a partial loss of power of volition in general. This, I think, gives the key note to the phenomena noticed. Holding a sensation steadily under attention requires an effort, in fact, even when the sensation is strictly attended to, it unquestionably undergoes continual fluctuation of conscious intensity. Attention, even in its simplest form, the so-called involuntary attention,

includes an element of subjective reaction to the sensation ; it is a phenomenon of will in its simplest stage. This decrease of will power, or reacting power, would render the fluctuations of attention greater. The remoteness in time seems to depend on the weakness of attention. As already stated, the actual time does not seem longer ; events are as correctly localized in time as in space. But whenever a memory of a past event, even though it occurred only a minute ago, is called up, it seems to belong to the distant past. Memories are remoter the fainter they are. The calling up of a memory requires an act of voluntary or involuntary attention. Any weakness of will would tend to produce a weaker—and thus remoter—memory. Since we know that memories grow fainter as the time elapsed is longer, an over-estimation of the past is natural.

The remoteness of objects in space is due to a conscious or unconscious estimate of the effort necessary to reach them. When the effort is more difficult, as with fatigue, hemp, etc., its amount will be over-estimated ; objects will appear remoter than otherwise although our previous knowledge of their space-relations prevents any distortion of space itself.

The drug finally produced faint illusions, chiefly ceilings decorated with colored designs, and finally sleep. It is noteworthy that the progress of the drug took place in stages, there being a continual fluctuation between loss and recovery of power.

The conclusion seems to be that among the earlier phenomena produced by *Cannabis Indica* the most prominent is a diminution of the power of subjective reaction in sensations, or a decrease of primitive volition. This leads to an incapacity for both involuntary and voluntary attention whereby sensations are dropped out of consciousness for intervals of time. The loss of power of attention also affects the memories, making them much weaker ; this leads to an over-estimation of the remoteness of past events although time is not directly overestimated. The decrease of volitional power leads to an over estimation of the remoteness of objects from the person, since to reach them would require more effort than usual.

Finally, let me suggest some lines of experiment to be performed before and during the influence of hemp : 1st. the rate of voluntary tapping to test the effect on simple voluntary movements; 2nd. graphic records of the time of fluctuation of some sound, to determine the periods of fluctuation of attention ; 3rd. estimation and record of one second of time ; 4th. experiments on will-time. Owing to disagreeable after-effects of the drug on my organism I shall probably be precluded, for some time, from carrying out these experiments myself.

LETTERS TO THE EDITOR.

**Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

SCIENCE IN THE SCHOOLS.—A REPLY.

Science of Sept. 29 contains an article by Professor Chapin discrediting the value of scientific instruction below the High School, and questioning the wisdom of placing such instruction in the grammar and primary grades. Several evident misconceptions in the mind of the writer both as to the nature and value of such science work impel me to reply. The wisdom of introducing and maintaining in the grades systematic training in the sciences, is believed to be made apparent by the following nearly axiomatic statements.

1st. The prime function of the school is to *educate* the individual in order that he may be of the greatest service to society in general and himself in particular.

2. A person has acquired intellectual culture—is *educated*—only to the extent that he has learned to use *all* his mental faculties to the best possible advantage, and has incidentally obtained some knowledge. To quote from most worthy authority, these faculties should be "like a team, which is *quick, strong* and *in harness.*"

3rd, Real science teaching supplies a training absolutely necessary for complete mental development, vital, in many cases, to the highest success of the individual.

4th. The particular training cannot be said to have been obtained generally under the old regime, as is well known by those who have had to deal with the graduate of our grammar grade.

As a teacher of the natural sciences, who has been trying for some time to determine *where, what* and *how much* such instruction should be placed in the grades below the High School, allow me to present briefly the results to be accomplished and make some suggestions as to how a place may be made for it even in our already over-crowded courses. Thorough scientific training, such as may be given by skilled teachers, will yield the following results:

1. *The cultivation of the powers of observation ; the ability to obtain knowledge first hand through the agency of the senses.* This, of itself, brings no special mental vigor, for savages are known with sight and smell developed to such an extent as to rival that of the beasts about them, and yet who cannot appreciate number beyond the fingers of one hand. Combine such power, however, with a mind well trained in other directions and you may expect wonders in the trades and professions.

2. *The preparation of written records of these observations in clear, accurate, concise language, supplemented with equally clear* and *accurate drawings.* In this way the quality and value of the observations are to be tested, the facts fixed in the memory and there is supplied a rigid, most valuable and so sadly needed exercise in the vernacular.

3. *Logical reasoning upon these observations, the deduction of truth* and *generalization.* Logical habits of thought and the ability to generalize, of course, characterize the mind of the scholar, but by judicious training they may be developed, and even earlier in life than is generally supposed by education. If oue observes closely a bright active child of three or four years of age, he will be found to be continually forming judgments and generalizing. His conclusions are generally wrong because based upon a too limited number of observations. I have seen an *eleven weeks'* old iufant make a series of observations, form three identical judgments and then arrive at a general conclusion. There has been so little in our elementary school courses to develop or in any way to call into action the reasoning faculties, that this characteristic is soon lost sight of. Arithmetic, when properly taught, gives a valuable training in deductive reasoning. but the tendency of even our best texts has been to disregard the discipline and render the processes largely mechanical.

4. *The acquisition of useful knowledge.* The amount of useful information to be obtained from a series of properly graded science lessons, extending over a period of eight or ten years, is by no means inconsiderable. A good elementary knowledge may be obtained of botany, zoölogy, geology, physiology, physics and chemistry; enough for general culture and to enable the pupil to read with some intelligence along any or all of these lines in case he must now leave school. A child of my acquaintance, before he had reached the legal school age, could point out the parts of a flower, locate the principal organs and bones of his body and could identify a dozen and a half of animals by their physical properties.